Licensable Technologies

Novel Zeolite Synthesis Method and Materials

Applications:

- Separation Membranes
- Adsorbants
- Catalysts
- Non-linear optics
- Ion Exchange
- Biomimetic Materials

Benefits:

- Enables zeolite and molecular sieve crystals with aspect ratios of up to 100
- Allows orientation and morphology control
- Opens new market opportunities (e.g., zeolite separation membranes)

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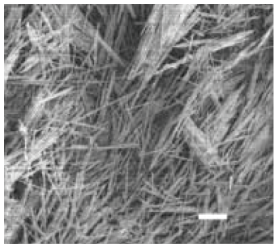
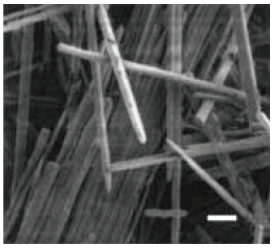
Summary

Zeolites and molecular sieves are used today in a wide variety of commercial applications including adsorption, shape-selective catalysis, membrane separations, nonlinear optics, and detergents. Because many emerging applications of microporous materials require precise control of crystal size and orientation, there is significant interest in developing new strategies to control crystal structure and morphology. Scientists at Los Alamos National Laboratory (LANL) have developed a new method for synthesizing these materials and have used it to create zeolite crystals. LANL's new reverse microemulsion method offers potential breakthrough performance enhancements in existing zeolite markets as well as the promise of completely new zeolite application areas. For example, zeolite-based membranes for separations are currently plagued by lack of control over orientation effects and imperfections. This new technology promises to provide orientation control for next-generation zeolite membranes.





These SEM images show aluminophosphate molecular sieve crystals ($AlPO_4$-5) produced using LANL's new method. The crystals are 200–300 nm wide and 15–30 microns long. The figure on the left has a 10-micron scale bar while the figure on the right is the same material with a 1-micron scale bar.

As the picture above shows, LANL scientists have created very long, thin molecular sieve crystals. The micropores in each crystal are aligned with the long axis of the crystal. The nanostructure of these crystals, combined with the high aspect ratio of length-to-width, directly enables several new application areas including optics, sensors, and membranes, in which the long, thin crystals can be deposited onto substrates with controlled crystal orientation. Reverse microemulsions are used in the new method to control the crystal morphology during synthesis at hydrothermal conditions.

Reference (available upon request):

M. Yates, K. Ott, Eva Birnbaum, and T. McCleskey, "Hydrothermal Synthesis of Molecular Sieve Fibers: Using Microemulsions to Control Crystal Morphology," *Angew. Chem. Int. Ed.* **2002**, *41, No. 3*

Development Stage

This technology has been reduced to practice; however, application-specific refinement may be necessary. LANL is now seeking industrial collaborators for this technology.

Patent Status

Patent pending

Licensing Status

This technology is available for exclusive or non-exclusive licensing. Please contact us for more information.

www.lanl.gov/partnerships/license/technologies/